

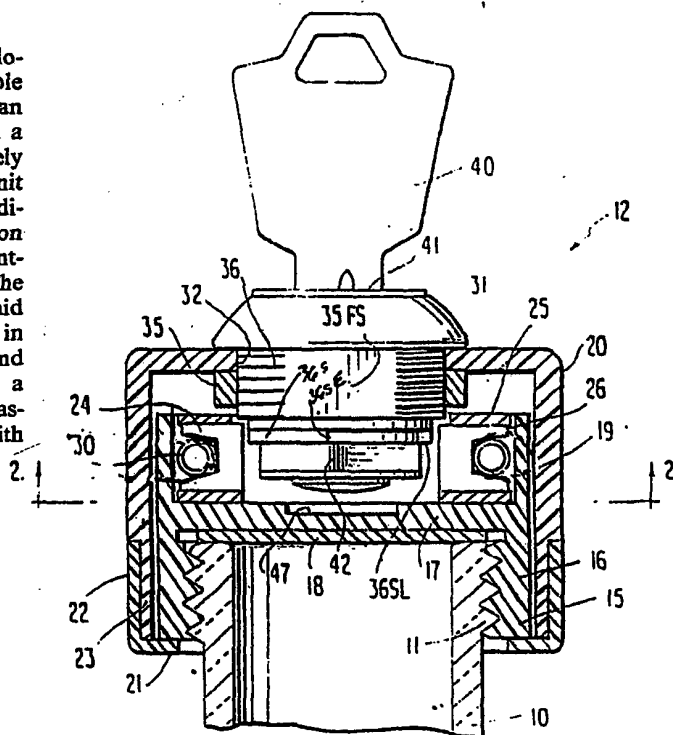


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(54) Title: LOCKABLE CLOSURE CAP**(57) Abstract**

A lockable closure cap assembly (12) includes a closure cap (16) having a threaded bore (11) for threadable engagement with the threads of a container neck (10), an annular shell (20) surrounding said closure cap, and a lock/cam/clutch (36, 42, 43, 24) mechanism for selectively engaging the closure cap with the annular shell to permit opening and closing the container. In a preferred embodiment, the mechanism includes at least one projection on the closure cap (119P1) and a lock assembly (152) mounted in a fluted bore (123) in said annular shell (120). The annular shell has a fluted bore (123) for receiving said lock assembly with one or more lock elements received in a flute to prevent rotation in the absence of a key, and permit rotation only on the presence of a key, and a clutch device operable only by a key (K) in said lock assembly to engage and disengage said closure cap with said annular shell.



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LOCKABLE CLOSURE CAP

BACKGROUND AND BRIEF DESCRIPTION OF THE INVENTION:

Safety closure caps are well known in the art. For many years there have been attempts to develop a lockable closure cap to prevent easy access to the contents of the containers such as whiskey bottles, medicines, drugs and the like. For example, in Kempin U.S. Patent 738,917, a lockable bottle stopper is disclosed in which a threaded stopper is threadably engaged with the threaded neck of a receptacle and a capsule or shell encloses the stopper and a swivel joint is provided between the stopper and the capsule. A key engaging mechanism on the stopper and a key for rotating the stopper causes the threads on the stopper to disengage the threads on the neck of the bottle. By turning the key in one direction, the web on the key element itself engage studs on the closure cap or stopper and screws the stopper onto the neck of the bottle and by reversing rotation of the key the webs also engage the studs to rotate the stopper in the opposite direction and unscrew the stopper off the bottle neck. After the stopper has been attached to the bottle and the key removed, the capsule or shell swivels upon the stopper and when turned will not turn the stopper or closure on the bottle. In Rouse U.S. Patent 3,426,932, a tamper proof poison bottle closure is disclosed in which a screw type main cap has a rib formed across the top thereof. An outer or auxiliary companion cap or shell has a deep depending annular rim encompassing the rim of the main cap

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with the lid portion thereof being spaced vertically above and parallel to the lid portion of the main cap and is swivelly mounted on a journal so that without a key, the shield freely rotates relative to the inner screw cap. A marginally threaded collar provides a rotary gear like pinion which coacts with a pair of rack elements guided in vertical guideways formed in the inner annular ware of the shield, so that upon rotation of the pinion by a key element, the engaged rack elements slide in their respective guideways into engagement with the rib extending across the top of the screw type main cap to thereby engage the outer shell or shield with the screw cap so that it may be removed. Several rotations of the key are required to cause an engagement of the racks with the rib on the top of the main screw cap.

THIS INVENTION:

The lockable closure cap disclosed herein provides an inner seal closure cap which is threadably engaged with the threaded neck portion of a conventional bottle or container, and an outer shield or shell member which is mounted for free rotation relative to the seal closure cap. In a first embodiment, engagement of the seal cap for twisting motion either on or off is provided by an annular cylindrical clutch element which is integrally formed with the closure cap and projects upwardly therefrom. The annular shell housing carries a lock element which actuates a cam member. A clutch shoe carrier has one or more laterally

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extending guideways which support one or more clutch shoe elements, which are maintained in an unactuated position by a spring or O-ring type spring. When the lock is actuated (either by a key or by a combination), the cam is rotated approximately 90 degrees and causes the ends of the clutch shoes to operably extend laterally relative to the vertical axis of the bottle or container and the cylindrical clutch element to engage and disengage with the annular surface of the annular cylindrical clutch element upon unlocking and locking, respectively, operation of the lock mechanism.

In a further and preferred embodiment, the clutch shoes have inner ends which are shaped to receive an activator which is rotated with the lock mechanism to always positively drive the clutch shoes in the carrier to engagement with an annular clutch element and to a disengaged position. This eliminates the annular spring and the attendant fitment of the clutch carrier and clutch shoes. The clutch element which is formed integral with the closure cap is comprised of one or more upstanding members. The clutch shoes are complementary shaped so as to serve as mutual guides for themselves, in conjunction with the carrier cavity walls. A simpler and less expensive lock mechanism is utilized. A part of the annular shell housing is used as the outer shell for the lock for interacting engagement

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with the lock pins or plates to thereby provide a less expensive key lock mechanism. The annular outer shell can be molded to accommodate various lock mechanisms. To facilitate and enable automated assembly, a rectangular projection on the inner upper surface of the outer annular shell rests inside a corresponding recess in the clutch carrier and prevents rotation of the clutch carrier relative to the outer annular shell.

Moreover, the annular outer shell can be molded in various artistic designs, heads of people, animals (e.g., a wild turkey or a horse), flowers (e.g., four roses) to promote various brands of liquid contents filling the bottles and letters can be embossed on the external plastic surfaces; and the key itself may have the finger/thumb portion thereof correspondingly artistically shaped or configured (e.g., a jockey for a horse-shaped outer annular shell).

DESCRIPTION OF THE DRAWINGS:

The above and other objects, advantages and features of the invention will become more apparent when considered with the following specification and accompanying drawings wherein:

Fig. 1 is a sectional view of a lockable closure for bottles incorporating the invention,

Fig. 2 is a sectional view through lines 2-2 of Fig. 1 showing the lock cam elements for actuating the clutch elements in the clutch carrier,

Fig. 3 is an side view of the clutch carrier and the

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clutch shoe elements,

Fig. 4 is a side elevational section view showing the clutch elements retained in position by the endless tension spring or O-ring spring,

Fig. 5 is a exploded sectional view of a preferred embodiment of the invention as shown in Fig. 1,

Fig. 6 shows a modification wherein the inner engaging groove and rib are utilized for retaining the unit in assembly,

Fig. 7a and Fig. 7b are a sectional view of a further modification, and

Fig. 8 is a perspective view of a combination lock mechanism applied to the lockable cap closure of the present invention.

Fig. 9 is a cross-sectional view of a preferred embodiment lockable closure cap with key inserted and lock pins retracted,

Fig. 10 is a top view of Fig. 9 with upper half of housing removed to show lock pins or plates retracted,

Fig. 11 is a cross-sectional view showing key inserted, lock pins retracted thus allowing go rotation of lock barred and lock pins or plates extension,

Fig. 12 is a top view of Fig. 11 with upper half clutch fingers extended in position to interfere with clutch posts integral with threaded closure cap,

Figs. 13 and 14 show lock mounting and proper orienting of clutch elements actuating cams and also shows square downwardly

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extending boss,

Fig. 15 illustrates inside the clutch carrier,

Fig. 16 is an exploded view of lower half of housing,

Fig. 17 is a cross-section illustrating location of cams above ledges provided in actuating clutch fingers, and

Fig. 18 is a modification on Fig. 11 illustrating an animal (horse) shape for the outer annular shell and shaping (jockey) of the key thumb/finger grip portion of the key.

DETAILED DESCRIPTION OF THE INVENTION:

Referring to Figs. 1 and 5, a bottle having a neck 10 with external threads 11 formed thereon is provided with a lockable closure 12 which, in this preferred embodiment, is a key lockable closure but it will be appreciated that it could be a combination lock, as shown in Fig. 8, in which no key is required. A closure cap 15 having an internally threaded annular sleeve 16 and cap member 17 provide the actual normal seal for the bottle or container 10 and may include a sealing disk 18 which may be plastic, cork, foam, etc. Integrally formed with the closure cap 15 is an upwardly extending annular cylindrical clutch element 19. By way of perspective, in the way of dimensions, the length of the closure cap 15 and its integrally formed cylindrical clutch element 19 may be about three-quarter of an inch in a key lock device. An annular shell housing 20 has an annular skirt 21 which has an axial length equal to or greater than the axial length of the closure

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cap, including the integrally formed cylindrical clutch element 19. An annular rib member 21 having an upstanding annular portion 22 telescopically received on the depending portion 23 of skirt 21 and is adhesively or ultrasonically secured thereto so that the annular rib 21 supports the closure cap 15 within the shell for free rotation therein. That is to say, the closure cap 15 and its integrally formed annular clutch element 19 are maintained in operative and freely rotatable relation and position in shell housing 20 by annular rib or flange 21, resulting in a less complex manufacturing and assembly process. A pair of clutch shoes 24, 25 are carried by annular clutch carrier 25 and slide laterally in slots 27, 28 in the clutch carrier 25. Clutch carrier 25 has an annular groove 29 and each of the clutch shoe elements 24, 25 have corresponding grooves 24G, 25G therein so that a spring 30 which may be a helical coil spring under tension or simply an O-ring spring having high elasticity properties serves to retain the clutch shoe elements in a disengaged position.

A conventional key lock mechanism 31 is received in opening 32 of annular shell housing 21 and is securely maintained therein by a lock nut 35 which is threadably received on the externally threaded lock casing 36. Thus, the lock is maintained securely in the annular shell housing between the lock nut 35 and escutcheon plate 38 by the tightening of lock nut 35. A conventional key 40 is received in a key slot 41 to operate the tumblers or discs (not shown)

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of the conventional lock 31. A downwardly projecting stop lug 36SL is engaged by stop ears 36SE to limit rotation of key lock component 36K to about 90 degrees, and thus limits the rotation of cam members 42, 43 to about 90 degrees. This assures that the cams do not over shoot the inner ends of clutch shoe members 24, 25 and when at either stop position, the clutch shoe members are fully retracted or fully extended laterally, e.g., that they are fully engaged with annular clutch cylinder 19 or fully disengaged from annular clutch cylinder 19.

Hole 32 is preferably not round, but has one or more flat sides to conform to the flat sides 35FS on lock casing 36 to prevent rotation of the lock casing 36 when the key 40 is rotated.

Cam elements or members 42, 43 are rotated with the rotation of a proper key 40 in slot 41. In this preferred embodiment, a quarter (90 degrees) of a turn of a proper key turns the projecting cam elements 42, 43 in a counter-clockwise direction as indicated by the arrow 44 (Fig. 2b). The cam elements 42, 43 are designed to engage the smoothly sloped peripheral edges 44 of the clutch shoe means 24, 26 which, when extended laterally, engage and/or disengage with the cut-outs 19CO in annular surface 19FS of the annular cylindrical clutch element 19. The outer edges 24FS, 26FS of the clutch shoe elements 24 and 26 respectively, are also designed to engage the internal notches or cut outs 19CO surfaces of the cylindrical clutch element only upon operation of the key to

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laterally project said clutch elements outwardly. The inner annular surfaces 19FS may be knurled or roughened, as may be the surfaces 24FS and 26FS. So that if the cut-outs are not engaged, there is high frictional engagement between the cam shoe's 24, 26 and the inner surface 19FS to apply twisting torque to the closure 15.

The spring member 30 serves to assure disengagement of the clutch shoe elements with the cylindrical clutch portion 19 when the key is operated to lock the assembly bottle and the proper positioning of the shoes for engagement by the cams. The bottle or container is in a "locked" condition when the shell housing 20 is able to freely rotate on relative to the seal cap closure 15. The lower end of the lock assembly 31 housing has an annular projection 46 which rests in and spaced from a shallow recession in the closure cap. Instead of a key lock, a conventional combination lock CL with number wheels NW, NW2...NWN can be used to operate the cams.

Referring now to Figs. 6, 7a and 7b, in these modifications the lower annular rib 21 and its upwardly extending skirt portion 22 are eliminated. An annular rib or ring 50 is molded or otherwise placed in the annular shell housing 20'. In Fig. 6, a complementary annular groove 51 is formed in the upwardly extending cylindrical clutch element 19'. After insertion and securement of the lock member barrel 36 in the shell opening 32, the clutch shoe carrier and spring elements are simply dropped or telescoped upon the lock barrel

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36 and then the closure cap and its annular cylindrical clutch element 19' are pushed into the housing with the rib 50, which in this case is rounded, camming the upper edge of the annular cylindrical clutch element 19' inwardly until the annular groove 51 is reached. The rib 51 is formed in the upper end of cylindrical clutch element 19' so as to provide adequate space for the clutch shoe elements 24 and 26 to sufficiently engage and frictionally grip the internal walls of the annular cylindrical clutch element 19'. In the arrangement shown in Fig. 7a, the annular groove 51' is formed in the wall of the annular shell housing 20'' and the annular rib 50' is formed in the outer surface of the annular cylindrical clutch element 19'' to thereby avoid the spacing requirement set forth in connection with Fig. 8. In Fig. 7b, a steel tension ring 50'', which has a gap 50''g is seated in annular groove 51'' in clutch element 19''' and is compressed upon being pressed into shell housing 20 and expands upon reaching internal annular groove 51IG.

It is evident that the present lockable closure cap device is easier to construct and assemble than the prior art and it does not require the multiple locations of a key in order to operate. Furthermore, it does not require the complex shapings of the interior of the shell nor the interfitting relationship of the component parts as required by the prior art. Moreover, it requires less component parts and uses a low cost conventional locking mechanism.

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Referring now to the embodiment shown in Fig. 9, a bottle having a neck 110 with external threads 111 is provided with a lockable closure cap 112 which, in this preferred embodiment is a key lockable closure but it will be appreciated that it could be a combination lock as disclosed above. Molded plastic cap member 115 has an internally threaded annular sleeve 116 and cap member 117 provide the actual normal seal for the bottle or container 110 and may include a sealing disk 118 which may be plastic, cork, foam, etc. Integrally formed with the cap member 115 is an upwardly extending annular cylindrical clutch element 119 which, as shown in the exploded view of FIG. 8 has a pair of upwardly extending prongs 19P1, 19P2. An annular shell housing 120, which is preferably molded of a hard plastic, but may be metal, has an annular skirt 21. Annular skirt member 121 has an upstanding annular portion 122 telescopically received in the depending skirt portion 123 of inner housing 120 and is adhesively or ultrasonically secured thereto so that flange or lip L on the annular rib 121 supports the closure cap 115 within the shell for free rotation therein. That is to say, the cap member 115 and its integrally formed annular clutch element 19P1 and P2 are maintained and operative and freely rotatable rotation and position by lower flange or lip L in shell housing skirt 121.

In this embodiment, a part of the annular shell housing is used as the outer shell for interacting engagement

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with the lock pins or plates to thereby provide a less expensive key lock mechanism. As shown best shown in FIG. 13, the upper annular shell housing 120 has an upper wall surface 121 in which is molded an annular lock cylinder 122 which has an series of elongated grooves or channels 123-1, 123-2, 123-3 and 123-4 (see FIG. 14) which are adapted to interact with the plates or pins 151-1, 151-2, 151-3 which are withdrawn upon insertion of the proper key into lock cylinder 50 (FIG. 5). As shown in FIG. 14, the plates 151-1, 151-3 project into slot 123-1 and thus prevent rotation of the lock cylinder 152 and key member 153 at the lower end thereof. Spring members (not shown) in the lock cylinder 150 normally urge or bias the lock plate members 151-2, 151-2, 151-3 outwardly as shown in FIG. 13 so as to provide a lockingly interengagement with the elongated grooves or channels 123-1...123-4 in the annular housing portion 120. The lock cylinder 50 has an annular shoulder 154 and cam stop member 55 on the lower surface thereof interengages with flutes 123F1, 123F2, 123F2, 123F4 to limit rotation of the lock cylinder 152 to about 90 degrees upon rotation of the lock cylinder with a key. The cam stop member engages a flute 123F1...123F4 and cams the lock cylinder upwardly over the upper edge of the engaged flute and against cupped spring 156 and retaining spring clip 157, which is received in annular groove 158 on the lower end of cylinder 152. Spring 156 and split spring retainer 157 bear against the lower surfaces 159 of the flutes 123F to retain the lock

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cylinder in place. Spring 156 may be eliminated or molded in lower surface 159.

The lower end 160 of the lock cylinder portion 122 of housing 120 has a generally square downwardly extending boss configuration so as to easily fit within a correspondingly square upper opening or chamber 161 in carrier 162 and prevent relative rotation. The sides of the opening 161 serves as guides for one or more clutch shoe elements 163, 164. The clutch shoe elements 163, 164 are complementary and only one need be described.

Clutch shoe element 163 has a clutch engaging projection 165 which slides into and out of slot 166 in carrier 162 and a guide surface 167, which slidably bears against wall 168 in carrier 162. A curved cam surface 169 is formed on the interior opposite guide surface 167 and is engaged by key cam member 153. A similar construction is provided in clutch shoe element 164 (corresponding numbered elements have been primed). The lower end 170 serves as an axle and passes through aperture 171 in the lower wall 172 of carrier 162 and into well 173 molded in the upper surface 117 of clutch element 115. With respect to clutch shoe elements 163 and 164, each has surfaces 163S1 and 163S2, and 164S1 and 164S2 which slidably coact in the manner shown in Figs. 10 and 12. Surfaces 163S4 and 164S4 engage walls 161L and 161R, respectively and act in conjunction with element 155 on the lock cylinder to permit the degree of rotation of the lock

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cylinder.

Figs. 10 and 12 illustrate the retraction (key removed) of clutch shoe elements 165, 165''. Fig. 10 shows cap 115, 116 closed on bottle 110 and stationary therewith and all other elements being freely rotatable relative thereto, and Fig. 12 shows clutch shoe elements 165, 165' projected to engage with clutch elements 119P1 and 119P2 so that rotation of cap element 15 to enable unscrewing same from bottle 110.

Referring now to Fig. 18, the outer housing 120 may be molded or shaped for aesthetic or artistic designs or advertising purposes. As an example, in Fig. 18, the outer shell is in the form of a race horse and key K is in the form of a jockey. Numerous other designs can be easily implemented, some of which have been referred to earlier herein.

While I have shown and described preferred embodiments of the invention, it will be appreciated that numerous modifications and adaptations of the invention will be obvious to those skilled in the art and it is intended to encompass such other modifications as come within the spirit and scope of the claims appended hereto.

WHAT IS CLAIMED IS:

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CLAIMS

1. A lockable closure for bottles and containers having a neck and external threads formed on said neck,

a closure cap having internal threads coacting with said external threads to seal said bottle, and an annular cylindrical clutch element projecting from integrally formed with said closure cap and rotatable therewith,

an annular shell housing having an annular skirt, said skirt having an axial length equal to or greater than the axial length of said closure cap and enclosing same to prevent external twisting access to said closure cap when engaged with the external threads on said neck,

annular rib means extending from one of said annular shell and said closure cap and a coacting shoulder on the other one of said annular shell and said closure cap for retaining said closure cap within said annular shell, and

said annular shell housing having a lock receiving wall at one end thereof and a lock mechanism secured in said lock receiving wall, said lock mechanism having laterally movable clutch shoe means operable to extend laterally to drivingly engage and disengage with said annular cylindrical clutch element upon operation of said lock mechanism.

2. The bottle closure defined in claim 1 wherein said lock mechanism has a pair of cam member means, said clutch shoe means including an annular clutch shoe carrier surrounding said

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lock mechanism, an annular groove formed in the outer annular surface of said clutch shoe carrier and an annular spring member seated in said groove below said annular surface, said clutch shoe carrier including at least one radially extending guide slot, and a clutch shoe in said guide slot, said clutch shoe having surface for engaging the cylindrical clutch element upon operation of said lock mechanism, said annular spring being constantly under tension and in engagement with said clutch shoe to move same to a disengaged position whereby said annular shell housing is freely rotatable relative to said closure cap.

3. The bottle closure defined in claims 1 or 2 wherein said cylindrical clutch element has one or more cut-outs formed therein for receiving said laterally movable clutch shoe means to effect a driving engagement with said closure cap.

4. The bottle closure defined in claims 1, 2 or 3 wherein said annular rib means is formed on the lower end of said annular shell housing and said coacting shoulder is constituted by the lower end of said closure cap.

5. The bottle closure defined in claims 1, 2 or 3 wherein said annular rib is formed on the interior of said annular shell housing near the upper end thereof, and said annular cylindrical clutch element has a complementary annular

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groove formed therein, the upper edge of said annular cylindrical clutch being adapted to be cammed inwardly by said annular rib and spring outwardly upon said annular rib seating in said annular groove.

6. The bottle closure defined in claims 1, 2 or 3 wherein said annular rib is formed on the external surface of said annular cylindrical clutch and said annular shell housing has an internal groove formed near the upper end thereof, the upper edge of said annular cylindrical clutch being adapted to be cammed inwardly by said annular rib and spring outwardly upon said annular rib seating in said annular groove.

7. A lockable closure cap assembly including a closure cap having a threaded bore for threadable engagement with the threads of a container neck, an annular shell surrounding said closure cap, and a mechanism for selectively engaging and disengaging said closure cap with said annular shell to permit rotation of said closure cap with said annular shell and free rotation of said annular shell with respect to said closure cap, respectively, characterized in that said mechanism includes at least one projection on said closure cap, a lock assembly mounted in a bore in said annular shell, said lock assembly having a cam operating member, a clutch shoe carrier rotatably nested on said upper surface of said closure cap, at least one clutch shoe slidably mounted in said clutch carrier,

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an arcuate cam surface formed in said clutch shoe and operatively engaged with said cam operating member so that said clutch shoe is moved solely by rotation of said cam to and from engagement with said at least one projection on said closure cap.

8. The lockable closure cap assembly defined in claim 7 including a projection on said closure cap, said lock assembly includes cylinder and a cam member on the lower end thereof, said clutch device includes a clutch shoe carrier nested in an upper surface of said closure cap, one or more clutch shoes in said carrier, and cooperating cam means formed on surfaces of said one or more clutch shoes, and an end of said cam member, respectively, so that rotation of said cylinder and cam member projects said shoe into engaging relation with respect to said projection.

9. The lockable closure cap assembly defined in claim 7 wherein said carrier includes a shaped, non-circular recess in the upper end thereof and coaxial with the rotary axis thereof, and said annular shell including an integrally formed internal member complementarily shaped to and received in said shaped non-circular recess.

10. The lockable closure cap assembly of claims 7-9 wherein said annular shell is an artistic design.

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11. A lockable closure cap assembly including a closure cap having a threaded bore for threadable engagement with the threads of a container neck, an annular shell surrounding said closure cap, and a mechanism for selectively engaging and disengaging said closure cap with said annular shell to permit rotation of said closure cap with said annular shell and free rotation of said annular shell with respect to said closure cap, respectively, characterized in that said mechanism includes at least one projection on said closure cap, a lock assembly mounted in a bore in said annular shell, said lock assembly having one or more key operated lock elements projecting laterally of the axes of said lock, said annular shell having a fluted bore in a surface thereof for receiving said lock assembly with said one or more lock elements received in a flute in said fluted bore to prevent rotation thereof in the absence of a key, and permit rotation only on the presence of a key, and a clutch device operated only by the presence of a key in said lock assembly to engage and disengage said closure cap with said annular shell.

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FIG 1

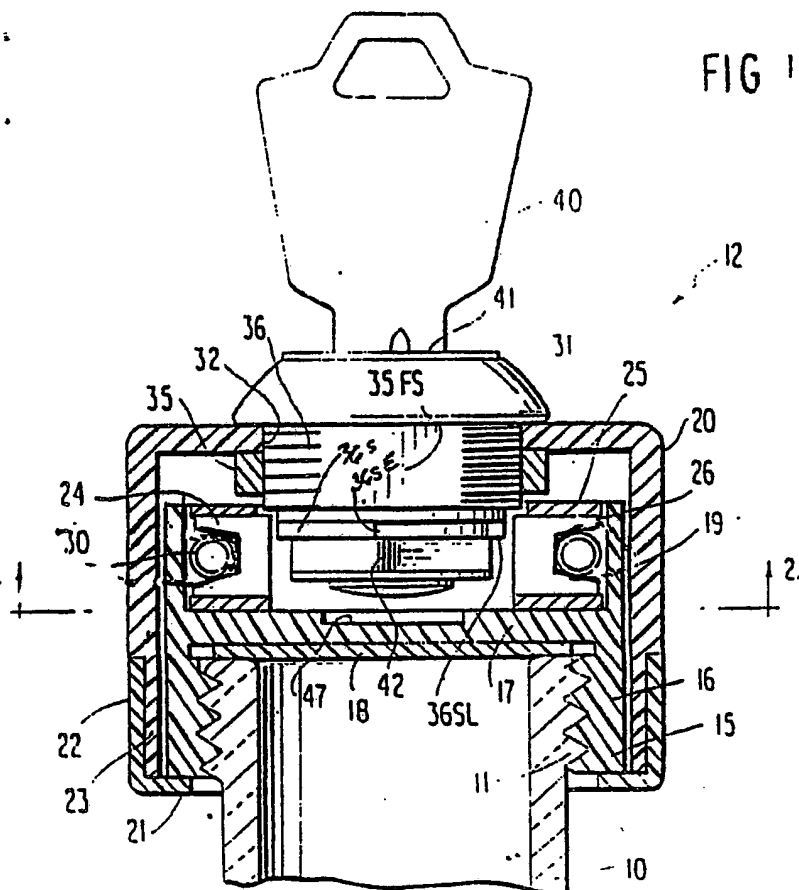


FIG. 2

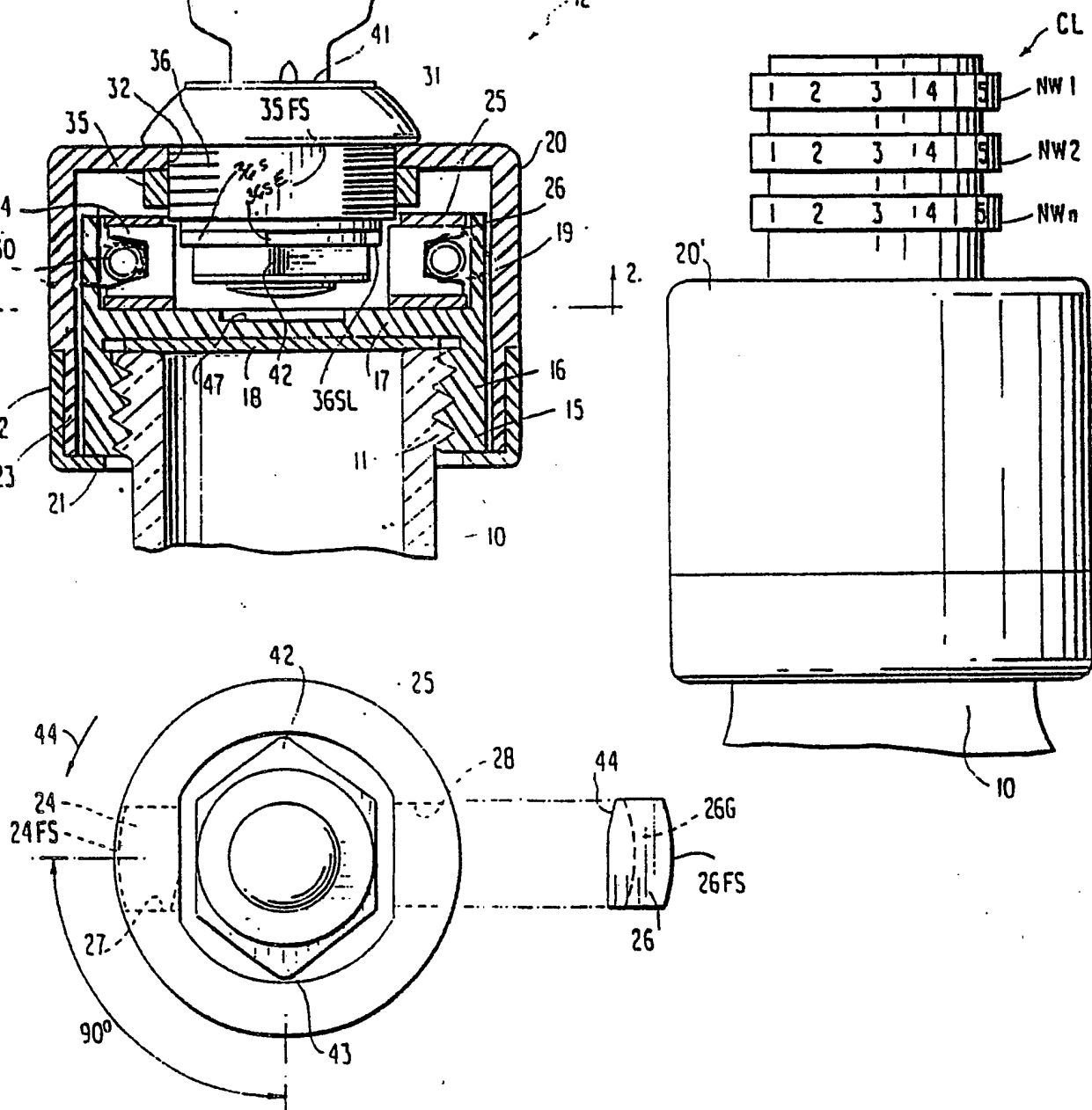
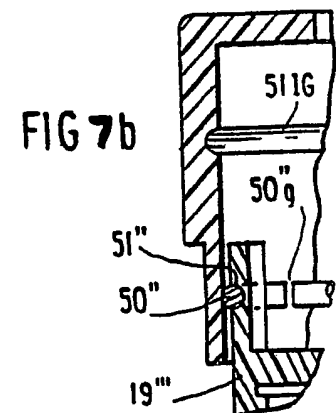
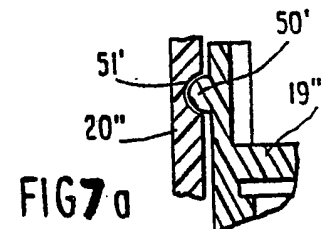
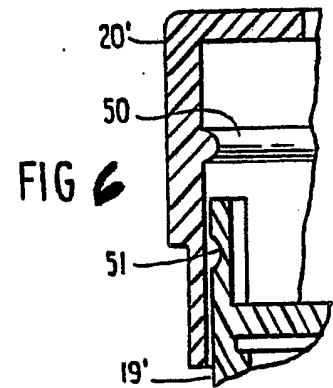
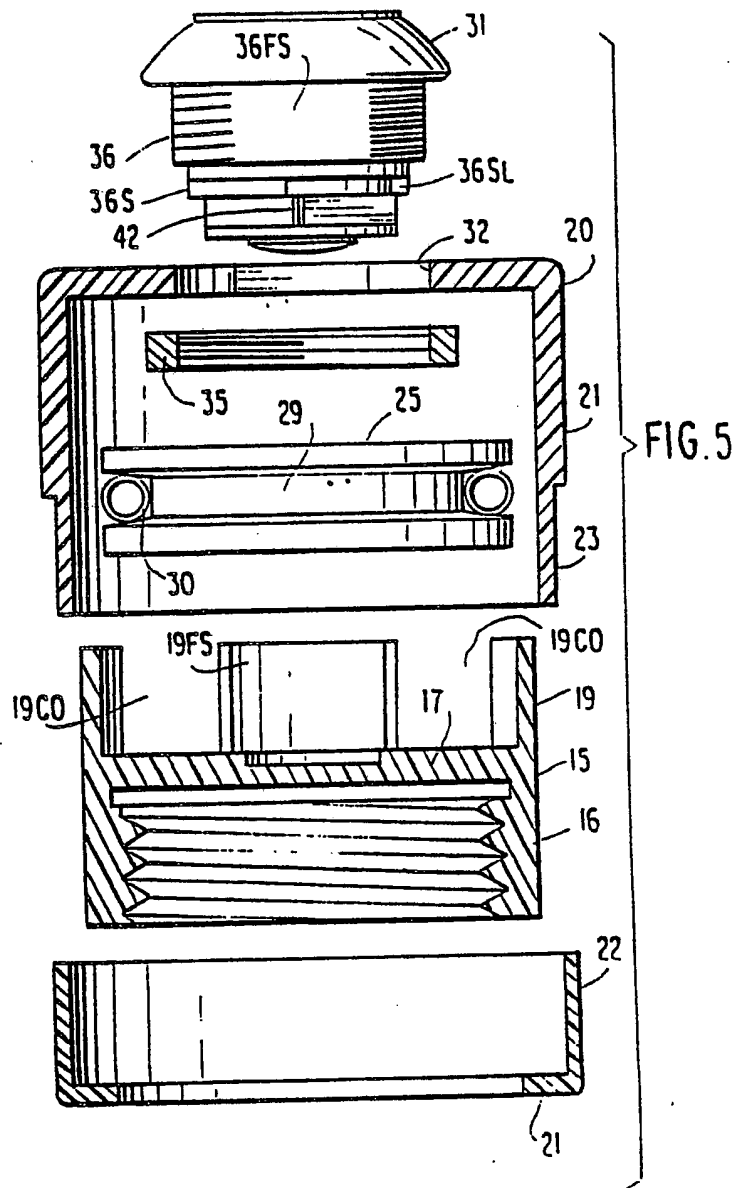
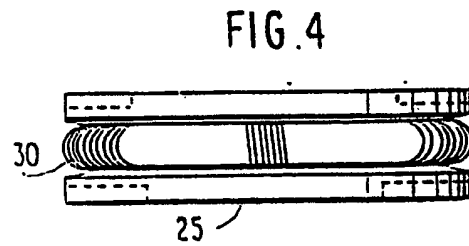
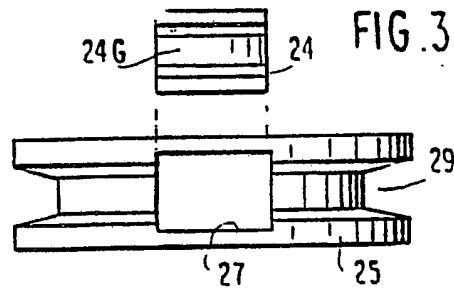
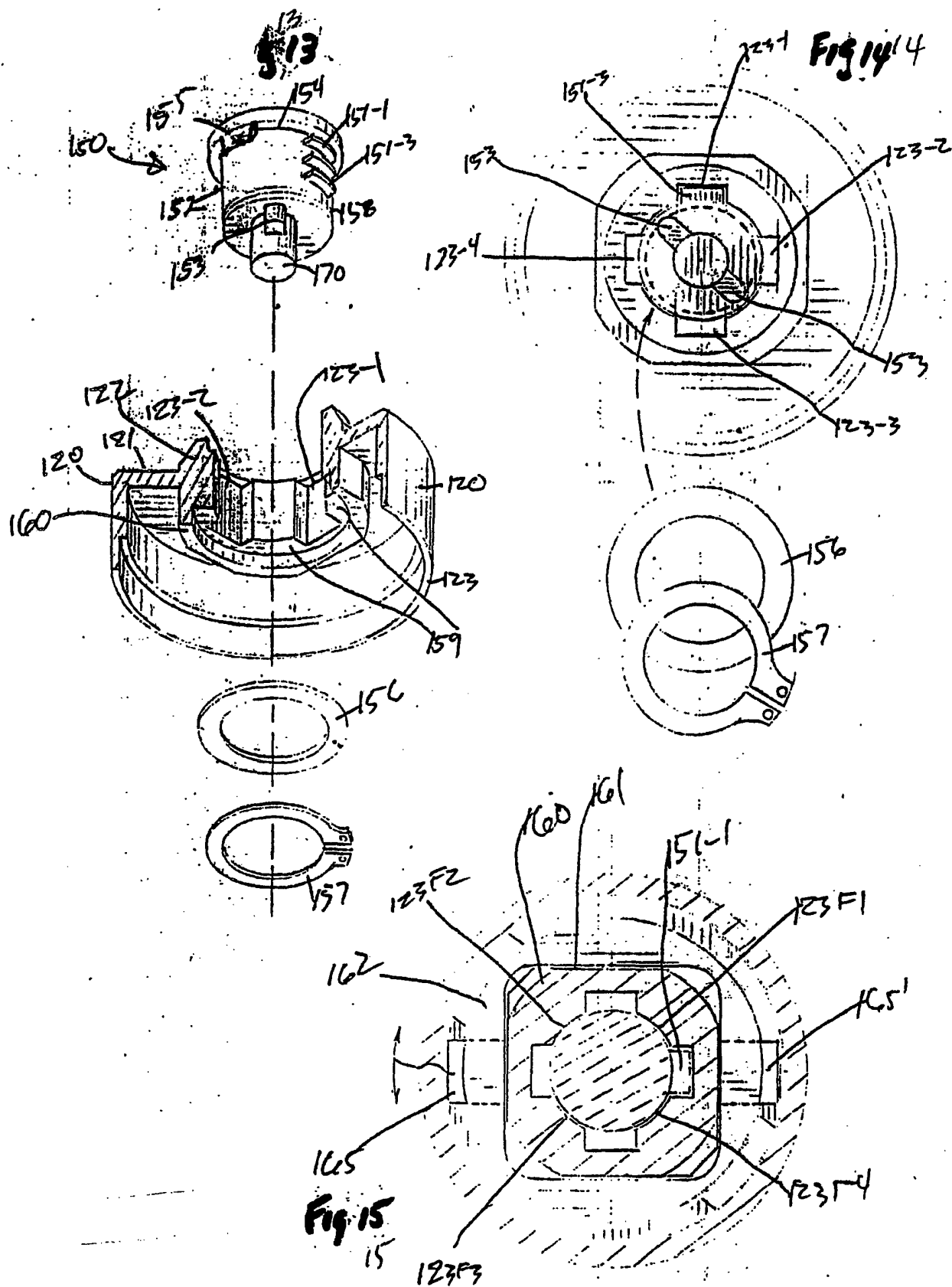


FIG 2

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INTERNATIONAL SEARCH REPORT

International Application No. PCT/US89/00037

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC <div style="margin-left: 40px;"> IPC (4): B65D 55/14 U.S. CL. 215/207, 219; 70/171 </div>																		
II. FIELDS SEARCHED <div style="text-align: center; margin-top: 10px;">Minimum Documentation Searched ⁷</div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; padding: 5px;">Classification System</td> <td style="padding: 5px;">Classification Symbols</td> </tr> <tr> <td style="padding: 5px;">U.S.</td> <td style="padding: 5px;">215/98, 207, 219; 220/210; 70/171, 172</td> </tr> </table> <div style="text-align: center; margin-top: 10px;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸</div>			Classification System	Classification Symbols	U.S.	215/98, 207, 219; 220/210; 70/171, 172												
Classification System	Classification Symbols																	
U.S.	215/98, 207, 219; 220/210; 70/171, 172																	
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; padding: 5px;">Category ⁹</th> <th style="width: 60%; padding: 5px;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 30%; padding: 5px;">Relevant to Claim No. ¹³</th> </tr> <tr> <td style="padding: 5px;">A</td> <td style="padding: 5px;">US, A, 3,343,697 ROBERTS ET AL 26 SEPT. 1967</td> <td rowspan="6"></td> </tr> <tr> <td style="padding: 5px;">A</td> <td style="padding: 5px;">US, A, 3,918,602 McINTOSH, 11 NOV. 1975</td> </tr> <tr> <td style="padding: 5px;">A</td> <td style="padding: 5px;">US, A, 4,223,799 EYSTER ET AL 23 SEPT. 1980</td> </tr> <tr> <td style="padding: 5px;">A</td> <td style="padding: 5px;">US, A, 4,299,102 ARO 10 NOV. 1981</td> </tr> <tr> <td style="padding: 5px;">A</td> <td style="padding: 5px;">US, A, 4,690,292 HENNING 01 SEPT. 1987</td> </tr> <tr> <td style="padding: 5px;">A,P</td> <td style="padding: 5px;">US, A, 4,775,061 COOTE 04 OCT. 1988</td> </tr> </table>			Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	A	US, A, 3,343,697 ROBERTS ET AL 26 SEPT. 1967		A	US, A, 3,918,602 McINTOSH, 11 NOV. 1975	A	US, A, 4,223,799 EYSTER ET AL 23 SEPT. 1980	A	US, A, 4,299,102 ARO 10 NOV. 1981	A	US, A, 4,690,292 HENNING 01 SEPT. 1987	A,P	US, A, 4,775,061 COOTE 04 OCT. 1988
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>																		
IV. CERTIFICATION <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;">Date of the Actual Completion of the International Search</td> <td style="width: 50%; padding: 5px;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="padding: 5px;">27 March 1989</td> <td style="padding: 5px; text-align: center;">05 MAY 1989</td> </tr> <tr> <td style="padding: 5px;">International Searching Authority</td> <td style="padding: 5px;">Signature of Authorized Officer</td> </tr> <tr> <td style="padding: 5px;">ISA/US</td> <td style="padding: 5px; text-align: center;"> Stephen Garbe </td> </tr> </table>			Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	27 March 1989	05 MAY 1989	International Searching Authority	Signature of Authorized Officer	ISA/US	 Stephen Garbe								
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FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

V. ☒ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE¹

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers , because they relate to subject matter¹² not required to be searched by this Authority, namely:

2. ☐ Claim numbers , because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out¹³, specifically:

3. ☒ Claim numbers 4, 5, 6, 7, 8, 9, 10, because they are dependent claims not drafted in accordance with the second and third sentences of PCT Rule 6.4(a). and 10

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING²

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.